

# MODIFICATION OF FUSED FILAMENT FABRICATION PRINTER TO PRINT HIGH TEMPERATURE THERMOPLASTICS TO IMPROVE Z-STRENGTH

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## ABSTRACT

A fused filament fabrication (FFF) desk top three dimensional printer was modified with a pre-deposition heating method using an infrared heat lamp in an omega shape around the printing nozzle to print high temperature materials and improve the tensile and flexural properties. The FFF additive manufacturing (AM) process is inherently a non-isothermal thermoplastic welding process that leads to anisotropic material properties. A non-traditional method to improve the strength using an infrared quartz heater as a pre-deposition heating system was developed and tested. The tensile and flexural properties of polylactic acid (PLA), polyetheretherketone (PEEK), polyetherketoneketone (PEKK) and polyetherimide (PEI) were evaluated. The goal of developing the desktop 3D printer to print high temperature materials equivalent to high end printers was achieved. The testing concluded that the printer modifications were successful in improving the material properties of low temperature PLA and that it gives the functionality to print high temperature materials such as PEKK and PEI. However, the modifications did not improve the “Z” strength anisotropy problem. PEKK was the easiest high temperature material to print. Overall, the material properties were comparable to material printed with high end printers and to some of the injection molded properties.